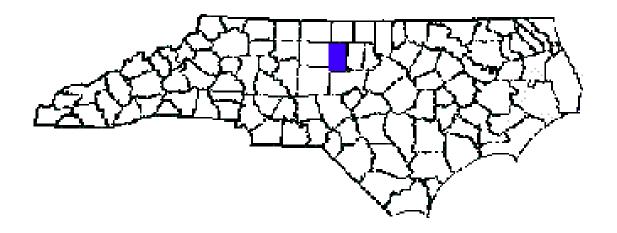
## **ANNUAL REPORT FOR 2007**



Michael's Branch Mitigation Site Alamance County TIP No. U-3110A



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August 2007

## TABLE OF CONTENTS

SUMN	IARY.	
1.0	Introd .1 .2 .3	uction:2Project Description2Purpose2Project History2
2.0	Strear	m Assessment:4
	.1 .2 .2.1 .2.2 .3 .3.1 .4 .4.1 .4.2 .4.3	Success Criteria4Stream Description4Post Construction Conditions4Monitoring Conditions4Results of Stream Monitoring5Site Data5Results of Stream and Buffer Vegetation8Description of Species8Results of Vegetation Monitoring8Conclusions9
3.0	Overa	Ill Conclusions and Recommendations:9
4.0	Refer	ences:
Figure	. 1 V/i	FIGURES icinity Map3
rigure	: I — VI	cinity iviap
		TABLES
Table	1 – Cr	oss Section Data5
		APPENDICES
Apper	ndix A -	- Cross Sections and Longitudinal Profile
Anner	ndix R -	- Site Photographs and Site Man

#### **SUMMARY**

The following report summarizes the stream monitoring activities that have occurred during the Year 2007 at the Michael's Branch Mitigation Site in Alamance County. This site was constructed during 2003 by the North Carolina Department of Transportation (NCDOT). This report provides the monitoring results for the second formal year of monitoring (Year 2007). The Year 2007 monitoring period was the second of three scheduled years for monitoring on Michael's Branch (See Success Criteria Section 2.1).

Based on the overall conclusions of monitoring at Michael's Branch, it has met the required monitoring protocols for the second formal year of monitoring. The channel and the structures throughout the stream are stable at this time. The streambank and buffer area are highly vegetated for the second year of monitoring.

NCDOT proposes to continue stream monitoring at the Michael's Branch Site for 2009.

#### 1.0 INTRODUCTION

#### 1.1 Project Description

The following report summarizes the stream monitoring activities that have occurred during the Year 2007 at the Michael's Branch Mitigation Site. The site is located just north of Interstate 40 on University Drive in Alamance County (Figure 1). The Michael's Branch Site was constructed to provide mitigation for stream impacts associated with Transportation Improvement Program (TIP) number U-3110A in Alamance County.

The mitigation project covers approximately 780 linear feet of channel length. Construction was completed during 2003 by the NCDOT. Stream restoration involved the installation of cross vanes, dual fiber logs, sloping the adjacent streambanks to promote stability, and widening of the floodplain to allow for major flood events. It also included the installation of coir fiber matting and live stakes along the streambank and bareroot seedlings in the buffer area.

#### 1.2 Purpose

In order for a mitigation site to be considered successful, the site must meet the success criteria. This report details the monitoring in 2007 at the Michael's Branch Mitigation Site. Hydrologic monitoring was not required for the site.

#### 1.3 Project History

December 2003
February 2005
September 2005
June 2007

Construction Completed
Planted Live Stakes and Bareroot Seedlings
Stream Channel Monitoring (1 yr.)
Stream Channel Monitoring (2 yr.)

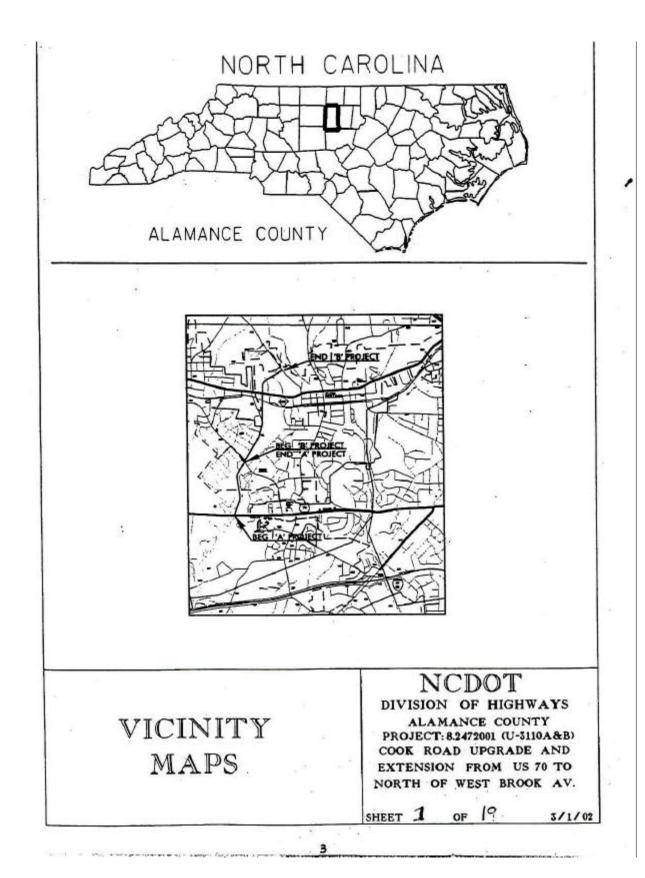


Figure 1.0 Vicinity Map

#### 2.0 STREAM ASSESSMENT

#### 2.1 Success Criteria

The following surveys were conducted in support of the monitoring assessment:

Stream Geomorphological Assessment

- ◆ The stream shall be monitored for a duration of 5 years from end of construction (channel modifications and vegetation planted)
- ◆ The data shall be collected and submitted to the NCDWQ and the US Army Corp of Engineers in the 1<sup>st</sup>, 3<sup>rd</sup>, and 5<sup>th</sup> years after construction
- The stream dimension shall be measured using permanent cross-sections (surveyed or GPS) established at a distance of 1 per every 20 bankfullwidths
- ◆ The measurements for dimension shall include a measurement of the stream width/depth ratio, entrenchment ratio, and low bank height ratio (low bank height/max. bankfull depth)
- The stream pattern shall be ascertained through measurements of stream sinuosity, meander width ratio, and radius of curvature (on newly constructed meanders only 1<sup>st</sup> year monitoring)
- The stream profile shall be ascertained by measurement of stream slope including the average pool and riffle slope as well as the overall stream slope.
- Pebble Counts for the stream shall be performed and presented to NCDWQ

#### Stream Vegetative Assessment

 Riparian buffers must be planted to achieve such that the survival of 260 stems/acre for trees after five years is attained. Tree densities of less than the prescribed amount will necessitate remedial actions by NCDOT.

#### 2.2 Stream Description

#### 2.2.1 Post-Construction Conditions

The mitigation of Michael's Branch involved the construction of rock cross vanes, installation of dual fiber logs, and additional bank sloping. Cross vanes were installed between glides and riffles. Coir fiber matting was installed along the banks throughout the entire reach.

#### 2.2.2 Monitoring Conditions

The objective of the Michael's Branch stream restoration was to build a C6 stream that has the potential to develop into a E5 stream as identified in the Rosgen's Applied River Morphology. A total of two cross sections (one in a riffle

and one in a pool) were surveyed. For this report, only cross sections containing riffles were used in the comparison of channel morphology presented below in Table 1. Data shown in Table 1 includes one cross section chosen to represent a riffle section.

Table 1.0 Cross-section Data

Variable				
	Proposed	2005	2007	2009
		Cross-Section #1	Cross-Section #1	
Drainage Area (mi²)	1.5	1.5	1.5	
Bankfull Width (ft)	25.0	21.8	22	
Bankfull Mean Depth (ft)	1.2	1.2	1.3	
Width/Depth Ratio	20.8	18.14	17.04	
Bankfull Cross Sectional Area (ft²)	29.7	26.19	28.24	
Maximum Bankfull Depth (ft)	0.6	2.22	2.86	
Width of Floodprone Area (ft)	>50	37.5	37.5	
Entrenchment Ratio	>2.2	1.72	1.71	
Thalweg Slope	0.003	0.005	0.006	

<sup>\*</sup>Drainage Area, Floodprone Width, and Slope are averaged values only.

<sup>\*</sup>Riffle values are used for classification purposes, pool values are shown in Appendix A.

Particle Sizes (Reach Count)	Proposed	2005	2007	2009
D <sub>16</sub> (mm)	N/A	1.14	1.78	
D <sub>35</sub> (mm)	N/A	4.85	0.92	
D <sub>50</sub> (mm)	N/A	8	1.78	
D <sub>84</sub> (mm)	N/A	15.79	14.43	
D <sub>95</sub> (mm)	N/A	40.67	21.94	

#### 2.3 Results of the Stream Assessment

#### 2.3.1 Site Data

The assessment included the survey of two cross sections and the longitudinal profile of Michael's Branch established by the NCDOT after construction. The length of the profile along Michael's Branch was approximately 250 linear feet. Two cross sections were established during the 2005 monitoring year. Cross section locations were subsequently based on the stationing of the longitudinal profile and are presented below. The locations of the cross sections and longitudinal profiles are shown in Appendix A.

- ◆ Cross-Section #1. Michael's Branch, Station 180.4 linear feet, midpoint of riffle
- Cross-Section #2. Michael's Branch, Station 225.5 linear feet, midpoint of pool

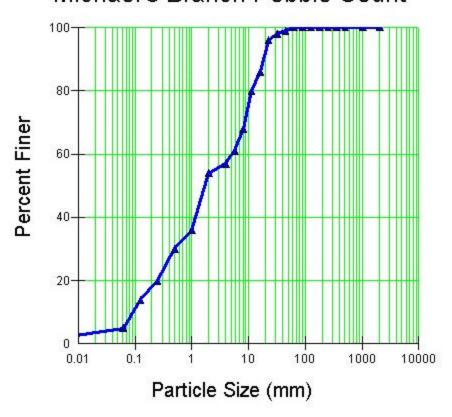
Based on comparisons of Year 2005 to Year 2007 monitoring data, both cross sections appear stable with little or no active bank erosion. Graphs of the cross sections are presented in Appendix A. Future survey data will vary depending on actual location of rod placement and alignment, however, this information should remain similar in appearance.

A representative pebble count was taken throughout the surveyed reach. This information is used to determine the stream type. Pre-construction data was not available for Michael's Branch. The pebble counts taken during the Year 2005 monitoring period noted that the  $D_{50}$  (50 percent of the sampled population is equal to or finer than the representative particle diameter) for the entire reach of Michael's Branch was approximately 8 mm, which is indicative of a gravel-bed stream.

The Year 2007 representative pebble count for Michael's Branch indicated a  $D_{50}$  of approximately 1.78 mm for the entire reach, which is, indicative of a sand-bed stream. Since no active bank erosion was observed on site, the increase in accumulation of finer material from 2005 to 2007 may be attributed to increased stream flow. Approximately four bankfull events were documented from September 2005 to present by quarterly monitoring evaluations under the Army Corp of Engineers permit. The increased stream flow could have distributed the finer material on site.

A chart depicting the particle size distributions for Michael's Branch for the Year 2007 is presented below.

## Michael's Branch Pebble Count



#### 2.4 Results of Stream and Buffer Vegetation

#### 2.4.1 Description of Species

The following tree species were planted on the stream bank:

Salix nigra, Black Willow

Cornus amomum, Silky Dogwood

The following tree species were planted in the buffer area:

Betula nigra, River Birch

Platanus occidentalis, Sycamore

Nyssa sylvatica var. sylvatica, Blackgum

Liriodendron tulipifera, Tulip Poplar

Fraxinus pennsylvanica, Green Ash

#### 2.4.2 Results of Vegetation Monitoring

**Streambank Vegetation:** The stream is highly vegetated throughout the channel with black willow, silky dogwood, and tag alder. Other wetland grasses noted along the channel are *Juncus* sp., woolgrass, cattail, jewelweed, and various grasses.

**Buffer Vegetation:** One vegetation plot was set to determine the trees per acre in the buffer area. There were no at planting counts conducted so therefore it is assumed that 39 total trees were planted in the 50 ft. x 50 ft. plot.

Plot#	River Birch	Sycamore	Blackgum	Tulip Poplar	Green Ash	Total (2 year)	Total (at planting)	Density (Trees/Acre)
1		3	1	4	1 5	2 3	3 9	4 0 1
A verage D ensity (Trees/Acre)								4 0 1

**Site Notes:** Other vegetation noted: lespedeza, aster, goldenrod, fennel, foxtail, multi-flora rose, briars, clover, pine, and various grasses. River Birch was noted outside of the plot location.

#### 2.4.3 Conclusions

There was only 1 vegetation monitoring plot established throughout the 1.97 acre planting area. The 2007 vegetation monitoring of the site revealed an average tree density of 401 trees per acre. This average is above the minimum success criteria of 320 trees per acre for year two monitoring.

#### 3.0 OVERALL CONCLUSIONS

The Michael's Branch Site has met the required monitoring protocols for the second formal year of monitoring. The channel and structures throughout the stream are stable at this time. The streambank and buffer area is highly vegetated for the second year of monitoring. NCDOT will continue monitoring in 2009.

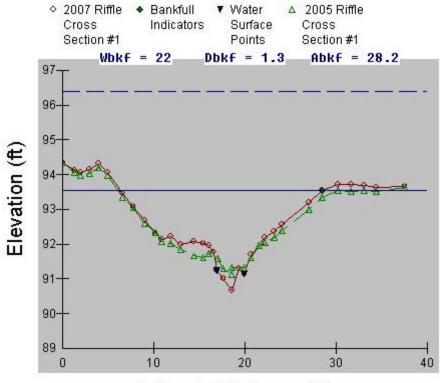
#### 4.0 REFERENCES

- North Carolina Department of Transportation (NCDOT), October 22, 2002. Permit for Cook Road Connector (U-3110A).
- Rosgen, D.L, 1996. Applied River Morphology. Wildland Hydrology, Pagosa Springs, Colorado.
- US Army Corps of Engineers (USACE), 2003. Stream Mitigation Guidelines. Prepared with cooperation from the US Environmental Protection Agency, NC Wildlife Resources Commission, and the NC Division of Water Quality.

### **APPENDIX A**

## CROSS SECTIONS AND THE LONGITUDINAL PROFILE COMPARISON

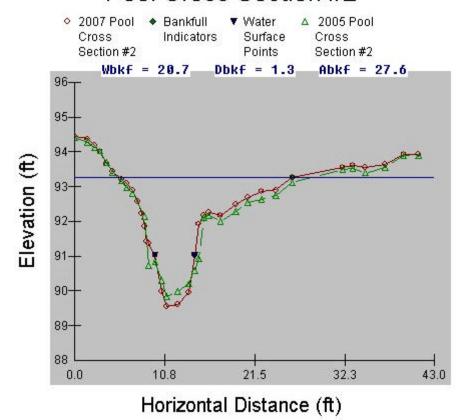
### Riffle Cross Section #1



Horizontal Distance (ft)

Cross-Section #1 (Riffle) Abbreviated Morphological Summary					
	2005	2007	2009		
Bankfull Cross Sectional Area (ft²)	29.7	28.2			
Maximum Bankfull Depth (ft)	2.22	2.86			
Width of the Floodprone Area (ft)	37.5	37.5			
Bankfull Mean Depth (ft)	1.2	1.3			
Width/Depth Ratio	18.14	17.04			
Entrenchment Ratio	1.72	1.71			
Bankfull Width (ft)	21.8	22			

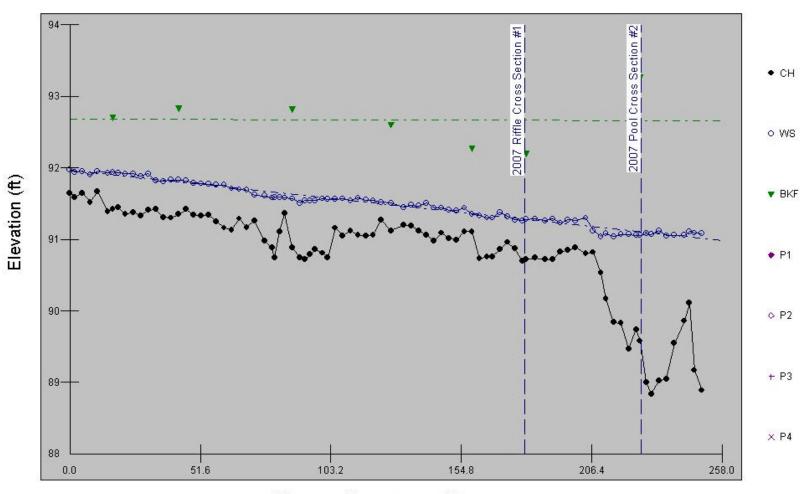
### Pool Cross Section #2



Cross-Section #2 (Pool) Abbreviated Morphological Summary\*

	2005	2007	2009
Bankfull Cross Sectional Area (ft²)	26.69	27.61	
Maximum Bankfull Depth (ft)	3.28	3.7	
Bankfull Mean Depth (ft)	1.32	1.34	
Bankfull Width (ft)	20.28	20.65	

<sup>\*</sup> According to the Rosgen Classification of Natural Rivers floodprone width, entrenchment ratio, and width depth ratio are not measured in pool, glide, or run features.



Distance along stream (ft)

# APPENDIX B SITE PHOTOGRAPHS AND SITE MAP



PP #1 (Upstream-East of University Drive)



PP #2 (Downstream-West of University)



PP #3 (Upstream-Cross Section #1)



PP #3 (Downstream-Cross Section #1)



PP #4 (Upstream-Cross Section #2)



PP #4 (Downstream-Cross Section #2)

June 2007



PP # 5 (Upstream-North of Sub-division Bridge)



PP #5 (Downstream-North of Sub-division Bridge)



PP #6 (Upstream-South of Sub-division Bridge)



PP #6 (Downstream-South of Sub-division Bridge)



PP#7 (Overview of Site Looking Downstream Towards the Sub-division Bridge)



PP#7 (Overview of Site Looking Across Site at University Drive)



PP #7 (Overview of Site Looking Upstream Towards University Drive)

